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RESEARCH PAPER

Habitat, nesting behaviour and collony organization of stingless bees *Tetragonula laeviceps* Smith

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Investigations on habitat, nesting behaviour and colony organization of stingless bees, *Tetragonula laeviceps* Smith in South Gujarat were undertaken at Navsari Agricultural University, Navsari during March 2012 to February 2013. For the purpose, colonies available in different districts of south Gujarat were observed. The results revealed that the colonies of *T. laeviceps* were observed in wall cavities (85.29%), tree cavities (8.80%) and pole cavities (5.88%) and located at height of 1160.71 mm, 1020 mm and 1065 mm from ground level, respectively. The entrance of the colony was made up of resin and the newly built entrance was soft, later turned darker and became rigid due to maturation. The length and width of entrance tube of colonies nested in wall cavities were 26.75 mm and 18.50 mm. Similarly, the colonies nested in tree cavities had the length and width of entrance tube to the extent of 38.50 mm and 20 mm. The colonies nested in pole cavities had the length and width of entrance tube to the extent of 5.00 mm and 21.50 mm. The studies on colony organization of *T. laeviceps* were made by opening five colonies. The colonies of *T. laeviceps* consisted of food storage zone and brood zone. Food storage zone was divided into pollen pots and honey pots. The length and width of pollen pots was 6.77 and 4.98 mm, respectively. The length and width of honey pots was 7.62 and 4.75 mm, respectively. The length and width of brood cells was 1.47 and 1.29 mm, respectively. The density of pollen pots, honey pots and brood cells were 13.50, 4.85 and 15 cells/cubic inch, respectively.

Key words : Stingless bee, *Tetragonula laeviceps*, Habitat, Colony organization, Nesting behaviour

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INTRODUCTION

Stingless bees are the smallest of the honey producing bees. They are highly social insects like honey bees living in permanent colonies, nesting in old walls, logs, crevices and such other concealed places. But the sting is greatly reduced without an effective tip. Hence, the defense behaviour is by chasing the intruders by biting, becoming entangled in the intruder's hairs and getting into the nose, ears and eyes. Stingless bees belong to the super family *Apoidea*, family *Apidae* and sub family *Meliponinae*. It consists of two genera *Melipona* and *Trigona* which belongs to the tribe *Meliponini* and *Trigonini*, respectively. *Meliponinae* includes eight genera, having 15 sub-genera and more than 500 species (Wille, 1983).

Recently, a new reference book on stingless bees was published in January 2013 called 'Pot-honey: a legacy of stingless bees.' Professor Michener contributed a chapter to this book in which he outlined a new classification for all the stingless bees, based on current scientific knowledge. In this new classification, the large genus *Trigona* has been split up into nine smaller genera and *Trigona* bees have all been placed in a genus called *Tetragonula* (Patricia *et al.*, 2013). The studies on various aspect of the nesting behaviour and colony organization of stingless bees were made by Smith, (1954); Pooley and Michener (1969); Starr and Sakagami (1987); Roopa (2002); Gajanan *et al.* (2005); Muthuraman (2006) and Danaraddi (2007). Very little attention has been paid to study the nesting habitat and other aspects of stingless bees in Gujarat so to avail the information on these aspects the present study has been under taken.

RESEARCH METHODOLOGY

Investigations on habitats, nesting behaviour and colony organization of stingless bees, *Tetragonula laeviceps* Smith in South Gujarat was undertaken at Navsari Agricultural University, Navsari during March 2012 to February 2013. The colonies of stingless bees available in and around Navsari and other districts of South Gujarat were observed for recording observations on nesting place, number of colonies nested in each place, height of nests from ground level, cavity dimension (width, height and length) and length and width of entrance tube to study their nesting behaviour. The colony organization of the nest was studied by opening five colonies and observations were recorded on dimensions of brood cells, pollen and honey pots, shape of the cells, colour of the cells, location of the cells in the cavity and density of cells (Number of cells/cubic inch).

RESEARCH FINDINGS AND ANALYSIS

The observations recorded on nesting habits and nests structure of stingless bees *T. laeviceps are* presented in Table 1. The data revealed that out of 34 colonies observed in different districts of South Gujarat, 29 (85.29%) colonies were located in wall cavity, 3 (8.80%) colonies in tree cavity and 2 (5.88%) colonies in pole cavity. *T. laeviceps* preferred closed structures for nesting and they never nested in open conditions. They adapted to nest in very narrow spaces, as the brood cells were in clusters which can be accumulated well in narrow cavities.

As regard to nesting height from the ground level, the observations revealed that nesting of cavities in wall were located at a height of 300 to 2550 mm with an average of 1160.71 ± 595.23 mm. The height of colonies in trees was varied from 330 to 2130 mm with an average of 1020 ± 970.72 mm while the height of colonies in pole was recorded at 810 to 1320 mm with an average of 1065 ± 360.62 mm. The nesting site of *Trigona* spp. was reported in tree cavities, cracks and crevices in old walls, stonewalls or mud walls, in termite moulds and bamboo cavities. (Smith, 1954; Starr and Sakagami, 1987; Roopa, 2002; Gajanan *et al.*, 2005 and Muthuraman,

Table 1: Nesting habitat of stingless bees, *T. laeviceps*

Nesting place	No. of colonies observed	Height from the ground (mm)	Extended entrance No.	Without extended entrance No.	Entrance tube length (mm)	Entrance tube width (mm)
Wall cavity	29	1160.71 ± 595.23 (300 to 2550)	15	14	26.75 ± 16.01 (10.00 to 55.00)	18.5 ± 8.52 (6.00 to 35.00)
Tree cavity	3	1020 ± 970.72 (330 to 2130)	2	1	38.50 ± 30.41 (17.00 to 60.00)	25 ± 17.32 (10.00 to 40.00)
Pole cavity	2	1065 ± 360.62 (810 to 1320)	2	0	21.5 ± 12.02 (13.00 to 30.00)	5 ± 0.00 (5.00 to 5.00)

Figures in the parentheses are the range value

Table 2: Internal structure of the nest of stingless bees, *T. laeviceps*

Parameters	Pollen pots	Honey pots	Brood cells
Dimensions			
Length (mm)	6.77 ± 0.37 (6.00 to 8.60)	7.62 ± 0.30 (6.86 to 8.70)	1.47 ± 0.19 (1.25 to 2.75)
Width (mm)	4.98 ± 0.35 (3.35 to 6.10)	4.75 ± 0.27 (3.60 to 6.05)	1.29 ± 0.20 (1.02 to 2.18)
Shape	Oval	Oval	Oval
Colour	Dark bown	Dark bown	Brownish
Location	The periphery of the colony	Inner periphery of the colony	center of the colony
Density(Cells/Cubic inch)	13.50 (10 to 17)	4.85 (3.80 to 5.90)	15 (14 to 16)

2006). Danaraddi (2007) reported that wall cavities offer excellent place for nesting *T. iridipennis* which confirms present finding on preference towards nesting in wall cavities.

The entrance of the colony was made up of resin and the newly built entrance was soft, later turned darker and became rigid at maturation. Similarly, Pooley and Michener (1969) reported that the nests of stingless bees usually consist of an external tube, internal tunnel, resin dump, waste dumps, wax dumps, food pots for storing pollen and honey, brood and nest envelopes like involucrum and batumen. As regard to length and width of entrance tube, the observations revealed (Table 1) that length of entrance tube in wall cavities was 10.00 to 55.00 mm with an average of 26.75 ± 16.01 mm while the width of entrance tube was 6.00 to 35.00 mm with an average of 18.50 ± 8.52 mm. Danaraddi (2007) reported that the entrance tube in *T. irridipennis* the colonies nested in wall cavities measured a mean length and width of 96.55 and 3.32 mm. The length of entrance tube in tree cavities was 17.00 to 60.00 mm with an average of 38.50 ± 30.41 mm and the width of entrance tube was 10.00 to 40.00 mm with an average of 20.00 ± 17.32 mm. Danaraddi (2007) reported that the entrance tube in *T. irridipennis* the colonies nested in tree cavities measured a mean length of 108.80 and 5.08 mm. The length of entrance tube in pole cavities was 13.00 to 30.00 mm with an average of 21.50 ± 12.02 mm and the width of entrance tube was 5.00 mm in both the colonies. As regard to presence and absence of entrance tube, fourteen colonies nested in wall cavities and one colony nested in tree cavity have no extended entrance tubes.

As regards to colony organization the colonies were consisted of food storage zones and brood zones internally. The observations on food storage zone revealed that it was further divided into pollen pots and honey pots. The honey and pollen were stored in separate pots, but these pots were often intermixed. The various dimensions pertaining to food storage zones (pollen pots and honey pots) and brood cells are presented in (Table 2). Pollen pots and honey pots were larger than brood cells and were sealed when filled.

The pollen pots were oval and made up of soft cerumen which was dark brown in colour and usually observed at the periphery of the colony. The length and width of pollen pots varied from 6.00 to 8.60 mm and 3.35 to 6.10 mm with a mean of 6.77 ± 0.37 mm and 4.98 ± 0.35 mm, respectively. The density of pollen pots ranged from 10 to 17 cells with a mean of 13.50 cells/ cubic inch. The pollen pots were compactly filled with pollen pellets and closed. Only few pots were found open which were used for storing incoming pollen. The pollen stored was little wet with sour taste. Danaraddi (2007) recorded the mean dimensions of pollen pots of *T. irridipennis* as 7.26 and 4.49 mm in length and width, respectively, which is more or less similar to present findings.

The honey pots were oval, dark brown and slightly larger than the pollen pots and located at the inner periphery of the colony and some were often intermixed with pollen pots. The length and width of honey pots ranged from 6.86 to 8.70 mm and 3.60 to 6.05 mm with a mean of 7.62 ± 0.30 and 4.75 ± 0.27 mm, respectively. Density of honey pots ranged from 3.80 to 5.90 cells/ cubic inch with a mean of 4.85 cells/ cubic inch. Like pollen pots, honey pots were also sealed after ripening of honey. Danaraddi (2007) recorded the mean dimensions of honey pots of *T. irridipennis* as 7.73 and 5.04 mm in length and width, respectively.

Brood cells were smaller than pollen pots and honey pots. They were oval, brownish in colour and appeared like sorghum grains and arranged in a net work of narrow vertical pillars with horizontal connectives. These brood cells were found at the center of the colony and were arranged in cluster with a space which facilitated easy movement of bees within the cluster. The length and width of brood cells ranged from 1.25 to 2.75 mm and 1.02 to 2.18 mm with a mean of 1.47 ± 0.19 and 1.29 ± 0.20 mm, respectively. Density of honey pots ranged from 14 to 16 cells/ cubic inch with a mean of 15 cells/ cubic inch. They were surrounded by the honey and pollen pots. Danaraddi (2007) recorded the mean dimensions of brood cells of *T. irridipennis* as 2.14 and 1.70 mm in length and width, respectively. The variations in the length and width of brood cells may be due to difference species and geographical locations.

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